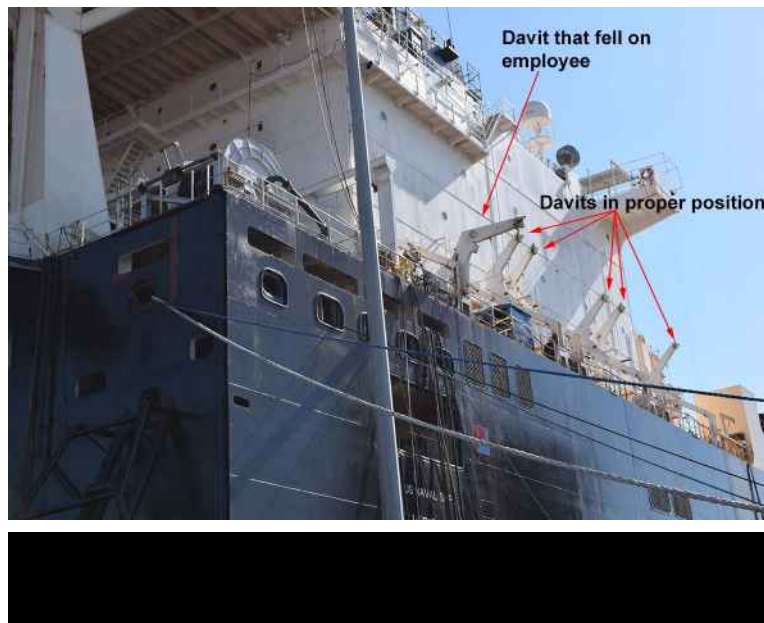


Exhibit D**U.S. Department of Labor****Occupational Safety and Health
Salt Lake Technical Center
Sandy, Utah 84070****Report Date:** 10 July 2019**Establishment:** Southern Skills Trades and Detyen's Shipyards, Inc.**Inspection Number:** 1391255, 1391322**Compliance Officer:** [REDACTED]**Area Office:** Columbia**Region:** 4**SLTC Investigator:** Daniel T. Crane**Evaluation of wire rope used for securing a davit on a ship during repair**

Wire rope was used to secure lifeboat davits in a fixed position during repair on the USNS LUMMUS. An employee began a burning or welding operation and one of the wire rope securing lines failed, allowing the davit to fall, striking him on the head, resulting in a fatal injury. The Salt Lake Technical Center (ALTC) was asked to determine if the failure was due to a direct welding strike or direct-contact electrical arc. Three sections of wire rope were submitted to SLTC and assigned sample number S29684.

Description

Figure 1 shows the position of the davits on the ship. Note that one of the davits is lowered. The wire rope that secured it failed and allowed it to fall, striking an employee who was working underneath it.



The davit is a Harkrader Gravity Davit, manufactured by Marine Safety Equipment Corp. in 1985.

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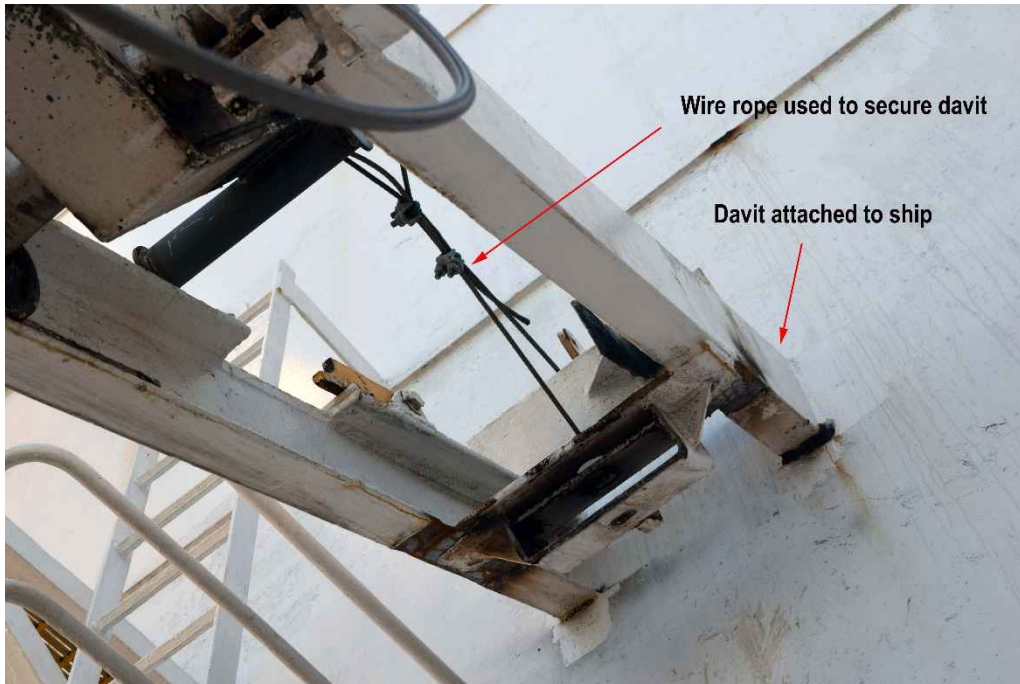
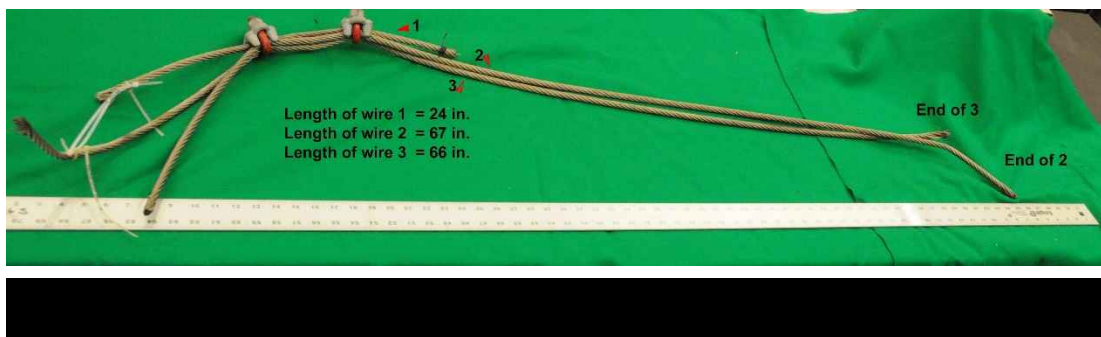


Exhibit D

Figure 4 shows the location of the ends of the failed wire rope before it was removed from the ship.



In use, the wire rope was secured with two wire rope clips. Figure 5 shows the wire rope sample with the wire ropes in place, as submitted with the lengths of each segment noted.



Segment 2 has a sharp bend at about 6 in. from the failed end. The bend is likely a result of the wire rope rigged around a sharp corner of an element of the davit without relief or protection. Figure 6 shows this bend and that the diameter of the wire rope was measured to be 10.01 mm (0.3941 in.). For reference, a 3/8 in. diameter wire rope is nominally 0.375 in.

Exhibit D

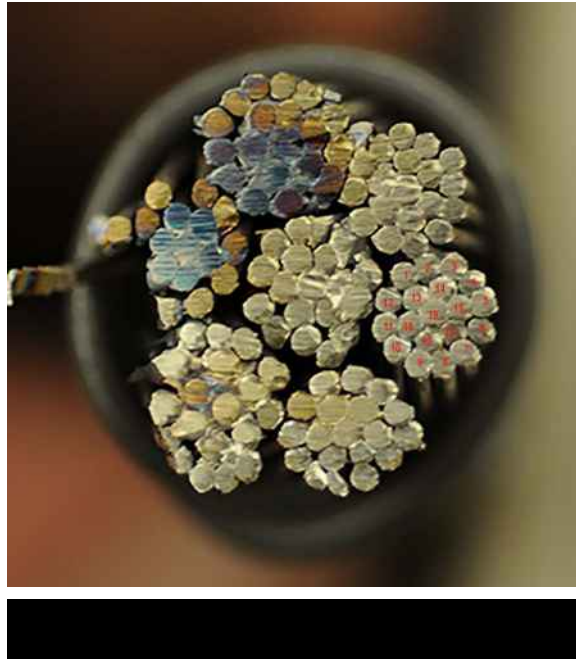
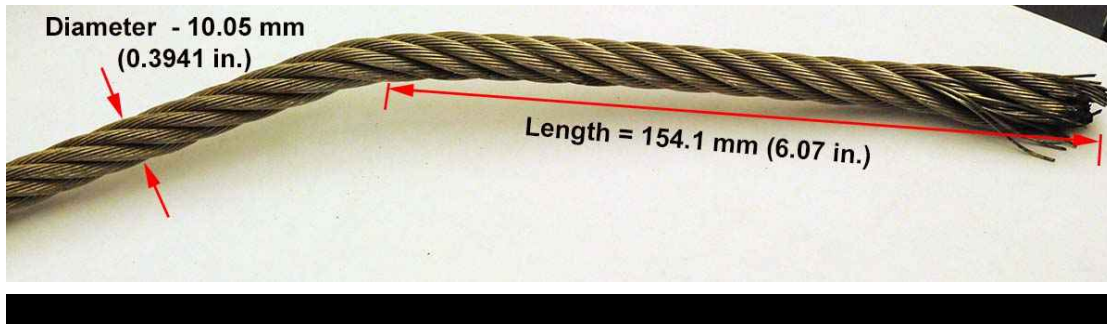


Figure 7 is an end-view of the wire rope. It may be classified as 7x19 construction by this pattern. The wire rope is stainless steel with Cr and Ni.



Exhibit D

Figure 8 shows the two failed ends. All of the strands and wires have failed at about the same location. A few of the wires failed in tension, demonstrated by necking and shear failure. Most of the damage at the ends is characterized by fusing. The presence of carbon deposits as shown in Figure 8 are evidence that the failure was a result of an electrical event.



Figure 9 is an image generated using the Keyence VHS1000 showing how the individual wires of the strands were fused together in the incident.

There was no obvious evidence of a welding strike on either failed end.

Discussion

The wire rope segments submitted for evaluation were originally a single length of 10 mm diameter 7x19 stainless steel rope used to secure a davit arm. The wire rope was in tension at the time of the failure, holding the davit arm in position. It failed and was subsequently cut from the structure in order to be sent to SLTC. This resulted in 3 distinct segments clipped together with two wire rope clips. The wire rope had been wrapped around a member of the davit which had sharp corners. The rope was not protected from the sharp corners and this resulted in at least 1 residual bend.

There was no evidence found of a strike by a welding rod. The wire rope failed due to an electrical arc.

Exhibit D

Such arcs are caused by a voltage potential difference between the wire rope and the superstructure to which it is attached.

Conclusion

The wire rope was used to secure a davit arm on the ship. When a current passed through it, it failed as a result of an electrical arc and allowed the davit arm to swing down and strike an employee fatally injuring him.